

***What Is Claimed Is:***

1. 1. A method for determining an exposure gap between a mask and a resist material wherein the  
2 resist material is exposed to an incident energy transmitted through exposure regions of the mask,  
3 comprising:
  - 4 providing first gratings on one or more sides of a first structure defined by one or more first  
5 regions of the mask;
  - 6 providing second gratings on one or more sides of a second structure defined by one or more  
7 second regions of the mask;
  - 8 exposing said first and said second structures to the incident energy;
  - 9 measuring a difference between a location in said first structure and a location in said second  
10 structure; and
  - 11 determining the exposure gap from said difference.
1. 2. A method according to claim 1, further comprising:
  - 2 using a mask writing tool to provide said first gratings and said second gratings.
1. 3. A method according to claim 1, wherein providing said first gratings comprises:
  - 2 providing gratings on an edge of an internal box structure defined by said one or more first  
3 regions, and
  - 4 wherein providing said second gratings comprises:

5           providing gratings on an edge of an external box structure defined by said one or more  
6    second regions located opposite from said adjacent edge of said internal box structure.

1    4.    A method according to claim 1, wherein providing said first gratings comprises:  
2           providing gratings on a pair of opposite edges of an internal box structure defined by said one  
3    or more first regions, and

4           wherein providing said second gratings comprises:  
5           providing gratings on a first edge of said internal box structure and on a second edge of an  
6    external box structure defined by one of said second regions, said first and said second edge being  
7    located opposite from one another.

1    5.    A method according to claim 1, wherein providing said first gratings comprises:  
2           drawing a plurality of pattern lines having relatively thin width portions and relatively thicker  
3    finger projectile portions on a semiconductor resist material, said thin width portions and said finger  
4    projectile portions placed in an adjacent manner to form a comb-like pattern.

1    6.    A method according to claim 1, wherein providing said second gratings comprises:  
2           drawing a plurality of pattern lines having relatively thin width portions and relatively thicker  
3    finger projectile portions on a semiconductor resist material, said thin width portions and said finger  
4    projectile portions placed in an adjacent manner to form a comb-like pattern.

- 1      7.     A method according to claim 1, further comprising:
  - 2                providing said first gratings and said second gratings to have the same pattern line widths.
  
- 1      8.     A method according to claim 1, further comprising:
  - 2                providing said first gratings and said second gratings to have different pattern line widths
  - 3                from one another.
  
- 1      9.     A method according to claim 1, wherein measuring said first and said second structures  
2                comprises:
  - 3                measuring a difference between a center in said first box structure and a center in said second
  - 4                box structure.
  
- 1      10.    A method according to claim 1, wherein determining the exposure gap from said difference  
2                comprises:
  - 3                applying an empirical relationship between a given pattern line width, a given exposure gap,
  - 4                and a given line shortening effect to determine the exposure gap.
  
- 1      11.    A method according to claim 10, comprising:
  - 2                using an optical metrology tool to measure center line shifts of said first and said second
  - 3                structures.

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1 12. A method according to claim 10, comprising:

2       using an alignment system of a proximity lithography exposure tool to measure center line  
3       shifts of said first and said second structures.

1 13. A method according to claim 1, wherein determining the exposure gap from said difference  
2 comprises:

3       exposing one or more test wafers to the incident energy, said one or more test wafers having  
4       different tool settings, said tool settings corresponding to one or more different exposure gaps;  
5       measuring critical dimensions of said test wafers;  
6       creating a calibration chart comparing said tool settings and said critical dimensions; and  
7       determining the exposure gap from said calibration chart.

1 14. A wafer for determining an exposure gap between a mask and a resist material wherein the  
2 resist material is exposed to an incident energy transmitted through exposure regions of the mask,  
3 comprising:

4       first gratings provided on one or more sides of a first structure defined by one or more first  
5 regions of the mask;

6       second gratings provided on one or more sides of a second structure defined by one or more  
7 second regions of the mask,

8       wherein said first gratings and said second gratings are exposed to the incident energy, and

9       wherein a difference between a location in said first structure and a location in said second  
10      structure is measured to determine the exposure gap therefrom.

1       15.    A wafer according to claim 14, wherein said first gratings are provided on an edge of an  
2      internal box structure defined by said one or more first regions, and  
3            wherein said gratings are provided on an edge of an external box structure defined by said  
4      one or more second regions located opposite from said edge of said internal box structure.

1       16.    A wafer according to claim 14, wherein said first gratings are provided on a pair of opposite  
2      edges of an internal box structure defined by said one or more first regions, and  
3            wherein said second gratings are provided on a first edge of said internal box structure and  
4      on a second edge of an external box structure defined by one of said second regions, said first and  
5      said second edge being located opposite from one another.

1       17.    A system for determining an exposure gap between a mask and a resist material wherein the  
2      resist material is exposed to an incident energy transmitted through exposure regions of the mask,  
3      comprising:  
4            first device that provides first gratings on one or more sides of a first structure defined by one  
5      or more first regions of the mask and second gratings on one or more sides of a second structure  
6      defined by one or more second regions of the mask;

7        second device that measures a difference between a location in said first structure and a  
8        location in said second structure before and after said first and said second structures have been  
9        exposed to the incident energy, and determines the exposure gap based on said difference.

1        18.    A system according to claim 17, wherein said second device comprises:

2            device that exposes one or more test wafers to the incident energy, said one or more test  
3        wafers having different tool settings, said tool settings corresponding to one or more different  
4        exposure gaps;

5            device that measures critical dimensions of said test wafers and creates a calibration chart  
6        comparing said tool settings and said critical dimensions; and

7            device that determines the exposure gap from said calibration chart.

8        19.    A method according to claim 17, wherein said second device comprises:

9            device that applies an empirical relationship between a given pattern line width, a given  
10       exposure gap, and a given line shortening effect to determine the exposure gap.

1        20.    A method according to claim 17, comprises:

2            device that uses an optical metrology tool to measure center line shifts of said first and said  
3        second structures.